the birds. The contributors on this occasion are Dr. Bowdler Sharpe, Mr. Ogilvie-Grant, and the editor, whose names are sufficient sponsors that the present volume is in no way behind its predecessors, which every section of the press has been unanimous in praising on account of the scientific excellence of the text, and the beauty of the illustrations. As a "Natural History," presenting a popular and comprehensive survey of the subject, the "Royal" is unsurpassed.

The now well-known two first volumes of the "Birds" in the valuable "Fauna of British India," which the India Office has been so well advised in publishing, were written by Mr. Oates. The present volume has been prepared by the editor of the series, Dr. W. T. Blanford, "who," as he says, "has endeavoured to keep the [continuation of the] work uniform in general plan, and to render the change in authorship as little conspicuous as possible." Everywhere throughout the book, the same care and pains that were manifest in Mr. Oates' two volumes are evident in the third before us. Thanks to Hume—the value or extent of whose unsurpassed gift to the nation has yet hardly begun to be appreciated as it must one day be—never before has material for an avi-fauna of India, approaching in its richness been anywhere brought together as that now conserved in the British Museum. The amount of comparison and original investigation demanded, consequently, of the authors in compiling for the first time since this collection has been available, the bird-fauna of our Eastern empire, has been enormously extended, as well as facilitated. Although Mr. Oates, on being prevented from completing the work he commenced, by his recall to official duty in India, handed over to Dr. Blanford, on his departure, the notes he had prepared for its continuation (which have been "of very great service," as the author admits), yet the more arduous part of the work had still to be done. That this task, slow, full of drudgery, and testing all the penetration and discrimination of the ornithologist, has been most conscientiously fulfilled, is evident on every page, and with a result in all respects on which Dr. Blanford is to be congratulated.

It had been intended to complete the "Birds" and (with that section) the Vertebrata of India with the present volume; but as the work progressed, it "became evident that the proposed third volume would be of inconvenient size," and it was, therefore, decided to divide it into the present and a concluding volume, which, it is stated, is now in an advanced state of preparation. The volume under notice includes the *Eurylæmi*, *Pici*, *Zygodactyli*, *Anisodactyli*, *Macrochires*, *Coccyges*, *Psittaci*, *Striges*, and *Accipitres*. The different orders are distinguished chiefly by their anatomical characters. The *Striges* are rightly kept distinct from the *Accipitres;* but the *Pandionidæ* are included within its limits. We should rather have seen them constituted a distinct order, *Pandiones*. It is with satisfaction we note that the publication of the final volume will not be long delayed.

NOTES.

THE long list of birthday honours contains the names of a few men distinguished for their scientific attainments. Prof. Max Müller is to be sworn of the Privy Council. Mr. Clements R. Markham, C.B., F.R.S., the President of the Royal Geographical Society, is promoted to be K.C.B., and Dr. David Gill, F.R.S., Astronomer Royal at the Cape, is made a C.B. Dr. J. G. Fitch, who until lately was Chief Inspector in the Education Department, and Mr. Le Page Renouf, the Egyptologist, have been knighted.

THE Chemical Society's Lothar Meyer Memorial Lecture will be delivered by Prof. P. P. Bedson, at an extra meeting of the Society on Thursday, May 28.

THE Cracow Academy of Sciences has appointed Prof. L. Natanson as its representative at the forthcoming Kelvin celebration at Glasgow.

THE Council of the Sanitary Institute have accepted an invitation from the city and county of Newcastle-upon-Tyne to hold a Sanitary Congress and Health Exhibition in that city in the autumn of this year.

PROF. ANGELO HEILPRIN has been appointed to represent the Academy of Natural Sciences of Philadelphia at the Mining and Geological Millennial Congress, to be held at Budapest, September 25 and [illegible], in connection with the celebration of the founding of the kingdom of Hungary. Messrs. Persifor Frazer, Angelo Heilprin, Benjamin Smith Lyman, and Theodore D. Rand have been appointed by the Academy as the Committee on the Hayden Memorial Geological Award for 1896.

ON the occasion of the Hungarian Millennium, the Emperor Francis Joseph has authorised the Budapest University to confer the following honorary degrees:—On Prof. Henry Sidgwick, of Cambridge, the honorary degree of Doctor of Political Economy; on Prof. J. S. Billings, of Philadelphia, and on Sir Joseph Lister the honorary degree of Doctor of Medicine; on Mr. Bryce, M.P., Mr. Herbert Spencer, Lord Kelvin, and Prof. Max Müller, the honorary degree of Doctor of Philosophy.

THE conversazione of the Society of Arts will be held at the South Kensington Museum on Wednesday, June 17.

PROF. E. SUESS, the well-known geologist, and Liberal politician, has just retired from his party in the Austrian Parliament.

THE death is announced of Prof. Germain Sée, the distinguished French pathologist, and member of the Paris Academy of Medicine.

A CONVERSAZIONE of the Society for the Protection of Birds will be held at the Royal Institute of Painters in Water Colours, Piccadilly, to-morrow evening.

WE learn, from the *Journal de Botanique*, that M. L. Diguet has been commissioned by the Minister of Public Instruction for France, and by the Museum of Natural History, with a botanical mission to Lower California, where he will probably make a prolonged stay.

MR. MARK JUDGE, Honorary Secretary to the Sunday Society, sends us the following statement of attendances on Sunday last at the great national museums in London:—South Kensington Museum, 2659; Bethnal Green Museum, 799; Geological Museum, 212; British Museum, 1790; Natural History Museum, 2398; National Gallery, 2106. The total is 9864, which number of visitors may be taken to justify the continuance of the Sunday opening of the museums.

THE Croonian Lectures of the Royal College of Physicians will be delivered on June 2, 4, 9 and 11, by Dr. George Oliver, who will take for his subject "The Study of the Blood and the Circulation."

ON Tuesday next, May 26, Prof. T. G. Bonney, F.R.S., will begin a course of two lectures, at the Royal Institution, on the "Building and Sculpture of Western Europe" (the Tyndall Lectures). On Thursday (May 28) Dr. Robert Munro will deliver the first of two lectures on "Lake Dwellings," and on Saturday (May 30) Dr. E. A. Wallis Budge, Keeper of the Egyptian and Assyrian Antiquities, British Museum, will begin a course of two lectures on the "Moral and Religious Literature of Ancient Egypt." The Friday evening discourse on June 5 will be on "Electrical and Magnetic Research at Low Temperatures," the lecturer being Prof. J. A. Fleming, F.R.S.

A SEVERE storm is reported by Reuter to have swept over Sherman, Texas, on Friday afternoon, completely destroying the western portion of the town. It is estimated that 120 persons, a large proportion of whom were negroes, were killed, and that 100 were injured. The storm, which travelled in a northerly direction over a path of 400 yards wide, swept everything before it. A waterspout burst at the same time over Howe, Texas, where eight persons were killed and many injured.

THE Swedish Tourists' Club has organised an expedition to the Great Lake Falls next August. The object of the expedition is to give those who join it an opportunity of seeing the total eclipse of the sun on August 9, of becoming acquainted with Lapland, and at the same time to see two of the finest waterfalls in Europe—the Great Lake Falls (Stora Sjöfallet) and Harsprånget. The party will start from Gellivare on August 3. Further information with reference to the journey can be obtained at the Tourists' Club, No. 28 Fredsgaten, Stockholm.

PROF. S. P. LANGLEY, who has for some time devoted attention to the problem of artificial flight, appears to have attained a remarkable degree of success. The New York correspondent of the *Daily Chronicle* reports that trials made with Prof. Langley's "aërodrome" have clearly demonstrated the efficiency and practicability of the invention. It is stated that "two upward ascents of about half a mile were made at a speed of twenty miles an hour. The machine in motion suggests a huge bird, soaring in large curves. When the steam gave out, the aërodrome sank gracefully and was picked up undamaged. No passengers were carried in the trial trips."

WITH reference to the reported dispatch of an American Antarctic Expedition under Dr. Cook, which was referred to in NATURE last week, we observe in the new number of the quarterly *Bulletin* of the American Geographical Society, New York, that the report is entirely incorrect, and that there does not appear to be "any immediate prospect of the launching of such an enterprise." The Belgian expedition, on the other hand, seems to be in course of rapid organisation; but it does not appear that the necessary funds have yet been completely subscribed. It will be under the command of Lieut. de Gerlache, of the Belgian Navy, and M. Arctowski will have charge of the oceanographical work to be carried out on board.

THE second annual meeting of the Botanical Society of America will be held in Buffalo, N.Y., on Friday and Saturday, August 21 and 22, 1896. Dr. William Trelease, Director of the Missouri Botanical Garden, will retire from the presidency, and will be succeeded by the President-elect, Dr. Charles E. Bessey, Professor of Botany in the University of Nebraska. At the evening session on Friday, August 21, the retiring President will deliver a public address on "Botanical Opportunity." The Botanical Society of America is affiliated with the American Association for the Advancement of Science, the sessions of which this year begin on Monday, August 24, in Buffalo.

THE Batavian Society of Experimental Philosophy at Rotterdam has offered prizes for the following botanical subjects:—The anatomical and chemical composition and vital functions of one or more at present undescribed species of plant natives of Holland or of the Dutch colonies; description of the vital conditions and properties of a mould-fungus, ferment, or bacterium of technical importance; new investigations on the action of flowers of sulphur or of copper salts on a pathogenous parasite; investigations on the presence, formation, and properties of the latex in the leaves of the caoutchouc-plant. For each subject a medal worth thirty duc. is offered; the work must be hitherto unpublished, and may be written in Dutch, German, French, or English. The essays must be sent, before February 1, 1897, with a motto, and the name in an enclosed envelope, to Dr. G. J. W. Bremer, Secretary to the Society, Rotterdam.

THE Ottawa correspondent of the *Times*, writing under date May 19, says: "The Royal Society of Canada, representing all the scientific and learned societies in the Dominion, met to-day. The business transacted included the adoption of a memorial to the Governor-General on the subject of the sixth resolution of the Prime Meridian International Conference of 1884, praying his Excellency's intervention with the home authorities with respect to the unification of nautical, civil, and astronomical time. Evidence was submitted establishing the fact that ship masters, both British and foreign, are almost unanimously in favour of the proposal, and that Canada, not only as a maritime portion of the Empire, but in other respects also, is peculiarly interested in the matter. It is strongly urged that the reform should be adopted so as to come into effect on the first day of the new century, and that, as nautical almanacs are prepared some years in advance, no time should be lost in adapting them to the change."

THE Paris correspondent of the *Chemist and Druggist* remarks that there are several pictures of interest to men of science at the Salon of the Champs Elysées this year. The most attractive of these is a decorative panel by Fournier, ordered by the State for the purpose of being placed in Pasteur's old laboratory at the École Normale Supérieure. The centre figure of the panel is an excellent portrait of Pasteur, who is depicted working by gaslight at a table in his laboratory, and the light is made to illuminate his fine features. Before him is a microscope, and he is shown in a reflective attitude as though about to make an entry in an open book that lies before him. Immediately above him is the figure of a woman personifying Science, receiving another, representing suffering humanity, in her arms. On the left are two young doctors in the act of inoculating a patient. On the right is a group of women, one holding forward her baby. A number of appropriate inscriptions appear on the panel.

THE *Weekly Weather Report* of the 16th inst. shows that the rainfall of the British Islands since the beginning of the year is deficient in all districts except the north of Scotland. The greatest deficiency is in the Channel Islands, where it amounts to 6·3 inches; in the south-west of England it amounts to 5·7 inches, and in the south of England to 4·5 inches. The severity of the recent drought may be judged by the following low falls in hundredths of an inch between April 17 and May 17, inclusive, in various districts:—Scarborough, 18; Spurn Head, 14; Cambridge, 17; Rothamsted, 8; Loughborough, 7; Oxford 0; London, 4; Dungeness, 10; Holyhead, 15; Prawle Point, 5; Donaghadee, 18; Roche's Point, 11; Scilly, 5. The general distribution of barometric pressure over our Islands during the drought has been anticyclonic, with light or moderate north-easterly and easterly winds; while areas of low pressure occasionally passed over the north of Scotland, and occasioned slight falls of rain in the north and west. On the 18th inst., however, a well-marked "V-shaped" depression passed across the northern parts of our Islands, causing rain at many stations, and amounting to half an inch in parts of Scotland.

THE rule followed by Irishmen at Donnybrook fair, to hit a head whenever they saw one, seems now to be applied to meteorological instruments. Writing from Edinburgh, Mr. W.

Black says a friend of his recently had his meteorological instruments upset and kicked about by Irish miners working in Lanarkshire. But the exuberance of spirits which led to this destruction is not confined to Irishmen, for Mr. Black says that at Duddingston Loch, some time ago, a number of Bank Holiday savages upset a complete meteorological equipment into the water near which it was installed; while in several northern towns it is necessary to enclose the instruments in iron cages to preserve them from being used as targets by the demon boy. Probably much of the destruction is the result of sheer wantonness, but anthropologists might be able to find evidence that the instruments are considered uncanny, in which case we should have to confess to the survival of the mediæval superstition against meteorology.

MOST workers with Röntgen rays have observed that a photographic plate becomes more or less fluorescent when the rays fall upon it. Mr. W. J. D. Walker informs us that a Paget xxxxx plate used by him fluorised so decidedly, that it made a very fair fluorescent screen, capable of showing coins in a purse, the bones of the fingers, screws and nails in a wooden block, and similar objects.

A NUMBER of excellent Röntgen photographs received from Mr. H. S. Pyne, of King William's College, Isle of Man, show that the Wimshurst machine is capable of producing effects comparable with those given by means of a good induction coil. The machine employed had plates fifteen inches in diameter, and the best results were obtained when the discharge was made intermittent. By this means the tube is rested, and, even with a quarter of an hour's continuous work, the phosphorescent area does not become appreciably warm. A Newton's "focus" tube was used, and the definition of the pictures produced by its radiations is exceedingly good and sharp. All the plates used were "Ilford rapid," with the exception of one, being a "Cadett" lightning. The latter plates Mr. Pyne has found to require the least exposure.

THE peculiar glow exhibited by a "focus" tube working well furnishes a good criterion of efficiency as regards Röntgen rays. A more definite means of comparing the actinic power of the radiation has been produced by Messrs. Reynolds and Branson, Leeds. A small quadrant of aluminium is constructed in concentric terraces, ranging from one millimetre to ten millimetres in thickness. By holding this quadrant between an excited Crookes' tube and a phosphorescent screen, the thickness of aluminium which the rays are capable of traversing can be seen upon the screen; or, by substituting a sensitive plate for the screen, the effect may be photographed. The "X-ray meter," as the quadrant is called, thus furnishes an easy means of comparing the intensity of Röntgen rays emitted by different tubes and by the same tubes at different times.

FROM Prof. A. Battelli and Dr. A. Garbasso, of Pisa, we have received several interesting papers describing their experiments on Röntgen rays. Referring to the discovery that the time of exposure required for taking photographs with these rays can be greatly shortened by placing certain fluorescent substances behind the photographic plate, the authors point out that they described a method of doing this in the January number of *Il Nuovo Cimento.* In some cases Prof. Battelli and Dr. Garbasso obtained good photographs with an exposure of only two seconds. In their paper, experiments were also described proving that Röntgen rays can be reflected (or at any rate scattered) from surfaces, but indicating an absence of refraction. Since the appearance of the above paper, Prof. Battelli has communicated two further papers to the same journal. In the first, the author arrives at the conclusion that Röntgen rays behave as if they emanate from the base of the vacuum tube rather than from the anode or kathode, also that they are emitted even after the discharge in the tube has ceased (as proved by the discharge of an electrified disc in the neighbourhood of the tube). In the second paper, Prof. Battelli deduces that the rays which emanate from the kathode in a vacuum tube possess photographic properties; that their action increases as the rarefaction increases (at least up to $\frac{1}{200}$ mm. of pressure); and that some of the rays are deflected by a magnet, while others are not. It is hence quite permissible to maintain that Röntgen rays exist in the interior of the tube. This view does not contradict the result that the rays *appear* to have their origin at the point where kathodic rays meet with an obstacle. It is easily seen that such an obstacle would act on the rays either as a filter or by scattering them in all directions.

THE various manurial trials conducted on behalf of the County Councils of Cumberland, Durham, and Northumberland in 1895, form the subject of a report by Prof. Somerville, of the Durham College of Science. Results of experiments on turnips, conducted at twelve centres, are considered to give a definite answer to the question as to whether it is the potash, the magnesia, or the salt in kainit that determines its value, its efficacy being attributed to the potash, which is the only substance that has consistently increased the average crop in these trials. No point has been more clearly demonstrated in the field trials of the last few years than that large dressings of dung or artificial manures do not increase the turnip crop to the extent usually supposed. It is argued that they would be more effective if they were applied in small quantities to each crop in the rotation as it came to occupy the land, instead of being, as at present, put into the land, say, every four years, to be exposed to all the wasteful agencies that may operate upon them till the plant food that they contain is exhausted. Manurial reform would seem to be most needed in the case of the artificial manures, since, for the incorporation of dung with the soil, the root-break offers facilities such as are afforded by no other crop in the rotation. The report includes details of experiments with finger-and-toe in turnips, and with *bouillie bordelaise* as a check upon potato disease.

THE report of the field experiments carried out in 1895 by the Agricultural Department of the University College of North Wales, Bangor, under the auspices of the County Councils of Anglesey, Carnarvon, Denbigh, Flint, and Montgomery, forms a brochure of some fifty pages. The experiments were concerned with the manuring of swedes, of pasture land, and of hay fields, the growth of oats from different quantities of seed, and the effects of various manures on the growth of vegetables. The work was conducted at more than thirty distinct centres, scattered over the five counties, and the question arises as to whether this is not too diffuse an application of energy to afford the best results. It is stated that within the last eleven years the trials "have gone on increasing until the number of centres has almost reached forty." Some of these places are nearly 150 miles apart, and many are far removed from railways. It is, however, correctly understood that these field trials are really intended to serve the purpose of object-lessons, "in which conclusions arrived at elsewhere may be made use of for the benefit of particular districts." There is considerable variation in the results obtained from the use of the same manures when applied to hay and pasture lands in different parts of North Wales. Phosphatic manures have proved the most satisfactory, and of these the most economical manure in the majority of cases was basic slag. The experiments, which must have involved a large amount of work, were conducted by Messrs. T. Winter, Bryner Jones, R. H. Evans, and F. V. Dutton. Every care should be taken to secure exactitude in such reports as this, intended for circulation amongst farmers

We notice that no denomination is given to the weights of seeds in the table on p. 47, though pounds, of course, are intended.

Messrs. Macmillan and Co. have made arrangements for the issue in New York and London of a "Dictionary of Philosophy and Psychology," under the editorial supervision of Professor Baldwin of Princeton University. All the matter in the Dictionary will be original and signed, and the several departments will be entrusted to men most competent to deal with them.

Writing with reference to the diagram published in Nature of February 27 (vol. liii. p. 404), to illustrate the movements of the terrestrial pole determined by Prof. Albrech, Mr. T. W. Kingsmill points out that the irregular variations in the curve are apparently coincident with remarkable seismic disturbances. He therefore suggests that there is a connection between movements of the earth's axis and unusual seismic activity.

We have received two more of the valuable publications of the Geological Survey of Canada, forming Parts B and M of Annual Report, vol. vii. The first of these is a Report on the Kamloops map-sheet of British Columbia, by Dr. G. M. Dawson. It is accompanied by two maps of the area, one strictly geological, the other glacial and economic, and the Report itself contains a number of reproductions of photographs of the district. The rocks of the area range from Cambrian to Tertiary and later, and are described at length; while topographical, meteorological, and mineralogical observations are also recorded. The whole volume consists of over 400 pages. The second is a Report by Mr. R. Chalmers on the surface geology of parts of New Brunswick, Nova Scotia, and Prince Edward Island. Besides minor matters of local interest, it includes discussions on the origin of the Bay of Fundy depression, the glacial striæ of the district, and the destruction of the forests. Several maps accompany the Report, and a photograph of the famous tidal bore in the Petitcodiac River, Bay of Fundy, deserves special mention.

True it is that at the Royal Victoria Hall, in Waterloo Bridge Road, music and mummery occupy a larger share of attention than lectures on scientific subjects. South London audiences have but a mere *penchant* for the generous new wine of science; they reserve their capacities for the variety entertainments. But though the audiences on Tuesday evenings, when scientific discourses are delivered, are very much smaller than on the evenings when a lighter vein predominates, they listen in a way which shows that they appreciate the fare provided for them. And it is satisfactory to know that most of the lecturers are in the front rank of scientific investigators, for this fact may be taken as a guarantee that sound information is imparted. The list of lecturers and subjects given in the report on the work of the Hall during 1895 is most creditable to the energy of Miss Cons, the Secretary, and to the generous spirit of the men of science who gave their services.

Following up the work which resulted in the preparation of the phosphoryl chlorobromides, M. Besson (*Comptes rendus*, May 11), by a similar method, has succeeded in preparing the corresponding thiophosphoryl derivatives. A mixture of hydrobromic acid and thiophosphoryl chloride passed over pumice at 400°–500° C. yields a liquid from which it is possible, by fractional distillation under reduced pressure (60 mm.), to separate both the intermediate chlorobromides. These substances resemble in their general behaviour the corresponding phosphoryl compounds. They undergo partial decomposition when distilled under ordinary atmospheric pressure, and are slowly acted upon by water. The chloromonobromide, ($PSCl_2Br$), has been previously obtained by Michaelis by the action of bromine upon $PSCl_2(OC_2H_5)$, but his product seems to have been impure.

The additions to the Zoological Society's Gardens during the past week include a Bonnet Monkey (*Macacus sinicus*, ♀) from India, presented by Mr. F. Greswolde-Williams; a Red-fronted Lemur (*Lemur rufifrons*, ♂) from Madagascar, presented by Mr. E. A. Pardoe; a Grison (*Galictis vittata*), a Black Tortoise (*Testudo carbonaria*), a Brazilian Tortoise (*Testudo tabulata*), a Rough Terrapin (*Clemmys punctularia*), two Scorpion Mud Terrapins (*Cinosternon scorpioides*) from South America, presented by Mr. J. J. Quelch; a Lesser Kestrel (*Tinnunculus cenchris*), captured off the coast of Sicily, presented by Mr. J. L. Spaull; a Natal Python (*Python sebæ*, var. *natalensis*), a Ring-hals Snake (*Sepedon hæmachetes*) from South Africa, presented by Mr. W. Champion; a Common Viper (*Vipera berus*), British, presented by Mr. H. L. C. Barret; eight Esquimaux Dogs (*Canis familiaris*), Arctic Regions, deposited; a Pied Crow Shrike (*Strepera graculina*) from Australia, two Whooper Swans (*Cygnus musicus*), European, purchased; two Barbary Wild Sheep (*Ovis tragelaphus*), born in the Gardens.

Erratum.—In the letter entitled "Simple Huyghens' Apparatus for the Optical Lantern," in the issue of Nature for April 9, instead of "a thickness of 1½ inches or more," read "of ½ inch or more."

OUR ASTRONOMICAL COLUMN.

The System of Castor.—A very interesting discovery with regard to this well-known binary star has been made by Dr. Belopolsky (*Bull. Acad. Imp. Sci. St. Petersbourg*, vol. iv. No. 3). In addition to the two luminous bodies, which perform their revolution in a period of about 1000 years, Dr. Belopolsky's observations indicate that the brighter star, α_1 Geminorum, has a dark companion very similar to that of Algol, except that it never produces eclipses. The existence of this dark body was suspected in 1894, and it was fully confirmed by photographs of the spectrum taken at Pulkowa early in the present year, showing periodic changes in the velocity of the star along the line of sight. Thirteen photographs were obtained, and from these the velocities of α_1 Geminorum towards or away from the sun were deduced. Although the available data are insufficient for a complete determination of the orbit, it may be taken to be circular as a first approximation, and a period of revolution of 2·98 days sufficiently accords with the spectroscopic measurements. The proper motion of the system of α_1 is 1·0 geographical mile (= 4·6 English miles) per second away from the sun, while the relative orbital velocity is 4·5 geographical miles (20·7 English miles) per second.

Dr. Belopolsky also tabulates the wave-lengths of some of the principal lines in the spectrum of α_1 Geminorum, which somewhat resembles that of Sirius in having broad lines of hydrogen, and many finer lines which are chiefly due to iron. α_2 Geminorum gives a spectrum with less numerous lines.

Efficiency of Photographic Telescopes.—Dr. Isaac Roberts has recently conducted an important series of experiments with the view of ascertaining the relative efficiency of a reflector and of portrait lenses for the delineation of celestial objects (*Monthly Notices*, vol. lvi. p. 372). It has often been asserted that portrait lenses have, by reason of their short focal lengths in relation to their apertures, greater photographic power than instruments of other forms; but this does not accord with Dr. Roberts's experience. A portrait lens of Dallmeyer's latest pattern, 3½ inches aperture and 9½ inches focus, and a 5-inch Cooke patent triplet lens of 19·2 inches focus, were attached with their cameras to the 20-inch reflector, and photographs of the same regions were taken simultaneously with the three instruments. The 5-inch lens was stopped down to a ratio of 1 to 4·8, while the ratio of aperture to focus in the case of the reflector was 1 to 4·9. In three exposures on the region of M. 33 Trianguli, the stars were 3½ times more numerous on the reflector photograph than on the photograph taken with the 5-inch lens in an equal angular area, and 7·8 times more numerous than in the case of the 3½-inch lens. At the same time the reflector photograph showed the nebula more extensively, more clearly depicted, at least two stellar magnitudes denser, and with far more structural details than can be seen on the other photographs.